DETAILED DESCRIPTION

[Detailed Description of the Invention]
[Industrial Application]This invention relates to the material used suitably for covering of wounds, such as a burn. This invention relates to the wound covering material which can be broken away without giving a patient pain easily [without doing damage to a wound side substantially, when the time of exchange of wound covering material or a wound heals] in more detail. Further, this invention relates to the wound covering material which can promote recovery at the same time it prevents infection of a wound side.
[Description of the Prior Art]If the wound covering material developed in order to cover and protect wounds including a burn conventionally is divided roughly from structure, it will be classified into the following two kinds.
1) It is the material represented by textile fabrics like gauze, a nonwoven fabric, or sponge, and let it be a structural feature to be rich in porosity.
2) Porosity is characterized by a dramatically scarce thing with the film which consists of living body origin materials, such as a kitchen, collagen, and fibrin, or polyurethane, silicone rubber, and artificial material like silicon gel.
Like above-mentioned both, there are the strong point and demerit in a completely different material on structure, respectively. The strong point of the wound covering material which comprises former porous high textile fabrics, a nonwoven fabric, sponge, etc., Since a lot of exudates secreted from a wound side can be held in a hole, Storage of the exudate in a wound side is prevented, since frequency's, such as infection, being lowered and porosity are high, an antimicrobial agent, a painkiller, or drugs like a recovery accelerator are applied from the outside of wound covering material, and it is mentioned that it is possible to make it arrive at a wound side. It is also the features to stick also to the wound side which carried out complicated shape well [a porous high material has high pliability and], and that oxygen still more nearly required for a wound side etc. can pass freely. On the other hand, the most serious thing as a problem of a high material of such porosity, If the exudate of an organization or an organization invades into the hole of material, the desorption after the time of exchange of material or recovery becomes very difficult and the above-mentioned material is removed by force, It is the organization which recovered with much trouble being damaged, there being no **, and removal taking time and effort in about [delaying recovery sharply], and giving a patient a remarkable pain simultaneously. In such porous materials, since it is that the evaporativity of moisture is too high, a wound side dries too much, and recovery is overdue, and big porosity, the problem that bacteria can arrive at a wound side from the exterior is pointed out. The strong point of material of on the other hand having the film description of the scarce latter in porosity, It is the difficulty of the exfoliation from the wound side which is the greatest problem of the porosity material mentioned above being improved remarkably, having the barrier nature of bacteria with the expensive material itself [this], greeting the excessive evapotranspiration nature of the moisture from a wound side, and being able to prevent desiccation of a wound side, etc. It is difficult things for the greatest problem of a porous low material to be lacking in the absorptivity of the exudate which is the strong point of a porous high material, and for a lot of exudates to store between wound covering material and a wound side on the other hand, and to become a good hotbed of bacteria propagation, and to make a remedy arrive at a wound side from the outside of material. In the material of film state, while various problems -- adhesion to the wound side which has

complicated shape is difficult -- have been unsolved, it is left behind. In order to cancel the above-mentioned various problems, some trials have been performed from before. For example, in order to improve the secession nature from the wound side which is a fatal problem of porosity material, what coated porous rayon textile fabrics with vaseline ointment (Shigehiko Kawakami et al..) [to the superficialness skin loss wound of non-sticking tendency gauze (tic / ADAPU /) / the clinical effect, the foundation and clinical], and 22, 1113 and 1988, What coated nylon textile fabrics with silicone (in order to obtain Fuji Ryosuke Mori and better wound dressing, it is clinical [of dermatology], and 32, 1403 and 1990) is developed. However, with the above-mentioned material, although detachability improves to some extent, if long term use is carried out to the wound surface where the depth of a lacking part is deep, difficulty will be dramatically followed on exfoliation. On the other hand, in order to improve the storage nature of the exudate from the wound side which is a serious problem of the material of porous scarce film state, the thing which put the slit into the material of film state, or the material which laminated the nonwoven fabric or hydro-gel of absorptivity in the wound side side of a film layer is developed (Motonobu Nakamura et al..) Development of the antimicrobial agent content wound covering material which consists of polyurethane membrane and an absorptivity nonwoven fabric - I Fundamental evaluation -, a Japanese form meeting magazine, 12, 443 and 1992, Fowler E.F. et al., and A new hydrogel wound dressing. for the treatment of open wounds, Ostomy/Wound Management37,39,1991. However, when the exudate from a wound side is abundant, an absorptivity nonwoven fabric or the water-absorption-power power of hydro-gel has a limit, and the reservoir of the exudate in a wound surface is accepted as compared with porosity material. As mentioned above, character in which the absorptivity of the exudate which is the strong point of porosity material is good and character of the ability to apply various kinds of drugs from the outside of covering material, and make it arrive at a wound surface, the effective wound covering material the detachability from the wound side which is the strong point of non-porosity material has covering material and the character of both who are called fitness was not developed conventionally.

[Problem(s) to be Solved by the Invention]As mentioned above, the purpose of this invention is lacking in the absorptivity of the exudate from a wound side, or there is in providing the secession nature from a wound side with the wound covering material which can solve simultaneously the problem of the conventional wound covering material that it is scarce.

[Means for Solving the Problem]Using material which contains wholeheartedly a temperature sensitive high molecular compound which has minimum critical solution temperature (below Lower Critical Solution Temperature; "LCST" outlines) as a result of research as wound covering material this invention person, It found out that it was very effective for solution of a problem mentioned above. LCST means transition temperature of hydration of a temperature sensitive high molecular compound, and the drying sum here (Haskims, M. et al., J.Macromol.Sci-Chem., A2 (8), and 1441 (1968) can be referred to for details of this LCST, for example). Hereafter, this invention is explained in detail.

(LCST) As for the above-mentioned temperature sensitive high molecular compound, in this invention, it is preferred that the above-mentioned LCST(s) are 0-50 ** (it is 50 ** or less more highly than 0 **) and also 0-37 ** (it is 37 ** or less more highly than 0 **). This LCST can be measured as follows, for example. When dissolving temperature sensitivity polymers in predetermined solution (for example, physiological sodium chloride solution) by about 1 wt% of concentration and carrying out temperature up at speed of about 3 ** in 1 minute using melting point apparatus, muddiness judges the first temperature to produce visually and sets this temperature to LCST. In this invention, at a temperature

higher than LCST, it is nonaqueous solubility and a temperature sensitive high molecular compound which serves as water solubility reversibly is preferably used by lowering temperature lower than LCST. At a temperature higher than LCST, since underwater is a solid state, such a temperature sensitive high molecular compound has a function as wound covering material. Since the above-mentioned temperature sensitive high molecular compound will be in a state of water solubility on the other hand if temperature is made lower than LCST when the time of exchange of wound covering material or a wound heals, and removing this wound covering material from a wound surface, It can remove from a wound surface, without giving a patient pain easily [without doing damage to a wound side].
(Temperature sensitive high molecular compound) As a temperature sensitive high molecular compound which can be preferably used for this invention, A poly N-substitution acrylamide derivative, poly N-substitution meta-acrylamide derivatives and these copolymers, polyvinyl methyl ether, polypropylene oxide, etherification methyl cellulose, a polyvinyl alcohol partial acetylation thing, etc. are mentioned. In this invention, especially things used preferably are a poly N-substitution acrylamide derivative, poly N-substitution meta-acrylamide derivatives or these copolymers, polyvinyl methyl ether, and a polyvinyl alcohol partial acetylation thing. LCST enumerates below high molecular compounds preferably used in this invention at low order. Polly N-AKUROIRU piperidine;. Polly N-n-propyl meta-acrylamide;. Polly N-isopropylacrylamide;. Polly N,N-diethylacrylamide;. Polly N-isopropyl meta-acrylamide;. Polly N-cyclopropylacrylamide; -- Polly N-acryloyl pyrrolidine; -- Polly N,N-ethyl methylacrylamide; -- Polly N-cyclopropyl meta-acrylamide;, even if polymers of the Polly N-ethylacrylamide above are homopolymers (homopolymer), It may be a copolymer of a monomer which constitutes the above-mentioned polymer, and other monomers. Both a hydrophilic monomer and a hydrophobic monomer can be used as other monomers which constitute such a copolymer. Generally, if copolymerization is carried out to a hydrophilic monomer, LCST will go up, and if copolymerization is carried out to a hydrophobic monomer, LCST will descend. Therefore, a high molecular compound which has desired LCST can be obtained also by choosing these monomers that should be carried out copolymerization. As the above-mentioned hydrophilic monomer, N-vinyl pyrrolidone, vinylpyridine, Acrylamide, meta-acrylamide, N-methylacrylamide, Hydroxyethyl methacrylate, hydroxyethyl acrylate, Hydroxymethyl methacrylate, hydroxymethyl acrylate, Acrylic acid and methacrylic acid which have an acidic group and those salts, vinylsulfonic acid, An N [which has basic groups such as still sulfonic acid,], N-dimethylaminoethyl methacrylate, N, and N-diethylaminoethyl meta-cleat, N,N-dimethylaminopropyl acrylamide, those salts, etc. are mentioned. On the other hand as the above-mentioned hydrophobic monomer, ethyl acrylate, methyl methacrylate, N-substituted alkyl meta-acrylamide derivatives, such as acrylate derivatives, such as glycidyl methacrylate, and a methacrylate derivative, and N-n-butyl meta-acrylamide, VCM/PVC, acrylonitrile, styrene, vinyl acetate, etc. are mentioned. Although wound covering material of this invention contains at least a temperature sensitivity compound which has the above-mentioned LCST, it may contain other ingredients if needed. it can set in such a mode -- "-- others -- as ingredient", a painkiller other than an antimicrobial agent mentioned later and wound healing promoting agent, etc. are mentioned, for example. in this case -- "-- others -- as for ingredient", it is preferred to use to temperature sensitivity compound 100 (weight) part in 0.5-30 copies and also 1-10 copies.
(Antimicrobial agent) In this invention, a ********** external use antimicrobial agent is preferably used by the present clinical one as an antimicrobial agent. More specifically, for example Silver nitrate, ****- aminobenzene sulfamide, Although gentamycin (gentamycin), silver sulfadiazine

(silver sulfadiazine), nalidixic acid, piromidic acid, pipemidic acid, norfloxacin, ofloxacin, ciprofloxacin, etc. are used preferably, It is not limited to these. As for the above-mentioned antimicrobial agent, it is preferred to use to 100 copies of temperature sensitivity compounds in 0.5-30 copies and also 1-10 copies.

(Wound healing promoting agent) As a substance which promotes wound healing in this invention, an extra-cellular matrix which has the effect of promoting epithelization is especially used preferably at the same time it improves compatibility to an organization. More specifically, for example as an extra-cellular matrix, collagen various type, fibronectin, vitronectin, a laminin, pro TEOGU recon, glycosaminoglycan, etc. are used preferably. Besides an extra-cellular matrix, since gelatin etc. which are the thermal denaturation things of collagen have the same effect, they can be used like the above-mentioned extra-cellular matrix. As for the above-mentioned wound healing promoting agent, it is preferred to use to 100 copies of temperature sensitivity compounds in 0.1-50 copies and also 1-20 copies.

A concrete example of (a manufacturing method of wound covering material), next a manufacturing method of wound covering material of this invention is shown. For example, by dissolving temperature sensitivity polymers in an organic solvent, or dissolving in water at a temperature lower than LCST, and carrying out solvent casting (solvent casting; solution flow casting) of this solution, Wound covering material which comprises a film of the above-mentioned temperature sensitivity polymers can be created. After coating with this temperature sensitivity polymer solution textile fabrics, a nonwoven fabric and sponge which are represented by gauze, or a base material of film state, wound covering material with which a support surface was coated with these temperature sensitivity polymers can be created by carrying out dry removal of the solvent. Thus, in a mode in which a support surface was coated with temperature sensitivity polymers, it is preferred about 0.1-50 mg and also that about 0.5-10 mg of temperature sensitivity polymers are coated [per 1 cm of base material ^{2} and] (with dry weight). By carrying out solvent casting by the same method as the above, after dissolving or mixing a substance etc. which promote an antimicrobial agent or recovery above-mentioned to a temperature sensitivity polymer solution, A temperature sensitivity high polymer film containing the above-mentioned substance or wound covering material with which the surface of a base material was coated with this temperature sensitivity high polymer film is producible. After dissolving temperature sensitivity polymers in water at a temperature lower than LCST and freezing solution of these polymers by cooling below to the freezing point of water, with a method of carrying out vacuum drying of this freezing thing and what is called a freeze drying method. Sponge of the above-mentioned temperature sensitivity polymers which have free passage porosity can be created. Textile fabrics represented with a temperature lower than LCST by gauze in solution of these temperature sensitivity polymers, After coating a nonwoven fabric, sponge, or a base material of film state, it is possible by freeze-drying this coating thing by the same method as the above to produce wound covering material with which a support surface was coated with temperature sensitivity polymers sponge of free passage porosity. By dissolving these temperature sensitivity polymers in water at a temperature lower than LCST, and freeze-drying like the above, after dissolving or mixing simultaneously a substance etc. which promote an antimicrobial agent or recovery above-mentioned in this solution, Wound covering material which comprises free passage porosity sponge of temperature sensitivity polymers containing the above-mentioned substance or free passage porosity sponge of temperature sensitivity polymers with which a support surface was coated is producible. On the other hand, wound covering material of this invention

is [temperature sensitivity polymers] also producible a graft or by carrying out graft polymerization on the surface of base materials, such as textile fabrics, a nonwoven fabric, sponge, or a film. The graft polymerization method to a base material of a monomer which should give these temperature sensitivity polymers can choose respectively optimal method according to construction material of a base material, shape, etc. For example, the low-temperature plasma polymerizing method has spoiling [little] character of bulk of a base material, It is possible to carry out graft polymerization to polymer, such as base material polymer which a radical does not generate comparatively easily, for example, polypropylene, polyethylene, polytetrafluoroethylene, poly dimethylsiloxane, polyester, and nylon, easily. In addition, it is usable suitably in graft polymerization method, such as an ozonate method or the cerium ion method, by character of base material polymer.

An example of (the directions for wound covering material), next directions for use at the time of actually using wound covering material of this invention is described concretely. Wound covering material of this invention is stuck on a wound surface, dryness or where dipping treatment is carried out to physiological sodium chloride solution of a temperature higher than LCST, and a wound surface is covered. When the time of exchange of this wound covering material or a wound surface recovers and this covering material is removed from a wound surface, Temperature sensitivity polymers which constitute this wound covering material can be changed to water solubility, and wound covering material can be made to exfoliate from a wound surface by changing this wound covering material into a **** state with water of a temperature (especially preferably temperature of nearly 4 **) lower than this LCST, and a physiological saline. Therefore, exchange thru/or secession of covering material is attained, without [in order that a substrate of the substrate of covering material of this invention itself or contacting parts with a wound surface of a base material may dissolve, without exfoliation of covering material becomes very easy and it does any damage to a wound surface of a recovery process, and] giving a patient pain. Although an example is shown below and this invention is explained to it still more concretely, the range of this invention is limited by claim and is not limited by the following examples.

[Example]

50 g of example 1N-isopropylacrylamide (NIPAAm, Eastman Kodak Co.) was dissolved in 650 ml of distilled water. The ammonium persulfate 5g and N,N,N',N'-tetramethylethylenediamine 100microl were added under the nitrogen air current after ice-cooling, it stirred at the room temperature further under ice-cooling for 12 hours for 5 hours, and the polymerization reaction was performed. Reaction mixture was warmed at about 50 **, after remelting deposit precipitation in recovery and chilled water, it warmed again and deposit precipitation was collected. After repeating this operation twice and refining it, vacuum drying was carried out and temperature sensitivity polymers and 48 g of Polly N-isopropylacrylamide (PNIPAAm) were obtained. When obtained LCST of the distilled water solution of PNIPAAm and the physiological saline solution (PNIPAAm concentration: 1wt%) was measured by turbidimetry, they were 32.5 ** and 30.8 **, respectively. PNIPAAm compounded by the above-mentioned method was dissolved in acetone, and concentration produced the acetone solution which is 5 w/w%. After immersing the gauze (Type I) of the Pharmacopoeia of Japan into this acetone solution and infiltrating this solution enough into the textiles of gauze, gauze was picked out from this solution, the nitrogen gas filtrated with my lex filter (a trade name, the Millipore Corp. make) was sprayed, the excessive solution was removed, and it dried for 10 minutes at the room temperature. Gauze was coated with PNIPAAm by repeating the above-mentioned process 3 times and performing it. When the weight

of the gauze before and behind coating was measured, the dry weight of coated PNIPAAm was about 2 mg per gauze 1cm^2. Although the microphotograph of the gauze before and behind coating was shown in drawing 1 and drawing 2 (magnification: all 32 times), respectively, in after disorder of the thin textiles seen before coating coating, change was hardly observed in the structure of gauze, such as an aperture of gauze, besides not having seen. Next, in order that the elution action of PNIPAAm with which gauze was coated might simulate how it changes in the time of using a damp or wet condition with the water of the state where it is used as wound covering material, and a temperature lower than LCST when removing from a wound surface, an experiment which is described below was conducted. By the above-mentioned method, coated gauze 100cm^2 is immersed in underwater [30-ml / 37 **], After neglecting it for one week, when the quantity of PNIPAAm underwater [this] was measured by the evaporating method, it became clear that PNIPAAm1.8x10 $^{-2}$ mg (about 1% of coated PNIPAAm) was eluted per gauze 1cm^2. Next, after lowering the temperature of the above-mentioned gauze immersion solution to about 4 ** and neglecting it for 5 minutes, When PNIPAAm eluted from this coating gauze was measured by the evaporating method, it became clear that 1.704 mg [per gauze 1cm^2] (about 85% of a coating amount) PNIPAAm was eluted. From the above-mentioned experimental result, the wound covering material of this invention, When maintaining the function as wound covering material and removing this covering material from a wound surface, without dissolving in the body fluid which exudes from a wound surface in the state where it was stretched in the wound surface, or the solution of the various drugs applied from the outside of this covering material, By using a damp or wet condition, PNIPAAm which constitutes this covering material dissolves and it is suggested that desorption from the wound surface of wound covering material becomes easy at the same time it sprinkles the water of a temperature lower than LCST from the outside of this wound covering material and lowers the temperature of this covering material to a temperature lower than LCST. PNIPAAm used in example 2 Example 1 was dissolved in 10 ** distilled water, and 1 w/w% of solution was produced. Subsequently, after covering with the Pharmacopoeia of Japan gauze (Type I) at the bottom into the petri dish whose path is 9.5 cm, 15 ml of the above-mentioned PNIPAAm solution was poured in into the petri dish, and gauze was dipped thoroughly. Next, after freezing the above-mentioned solution thoroughly by neglecting this petri dish to a -80 ** freezer for 2 hours, it freeze-dried one whole day and night using the vacuum dryer, and the wound covering material of this invention was produced. The scanning transmission electron microscope (scanning electron microscope) photograph (magnification : respectively 70 times and 560 times) of the surface of this covering material is shown in drawing 3 (a) and drawing 3 (b), respectively. The shape of this covering material had the shape of sponge which has a communicating hole whose aperture is about 50 micrometers. PNIPAAm used in example 3 Example 1 was dissolved in acetone, and concentration produced the acetone solution which is 5 w/w%.Silver sulfadiazine (silver sulfadiazine, Tanabe Seiyaku Co., Ltd. make) was dissolved in this acetone solution as an antimicrobial agent, and the abbreviation 0.2 w/w% solution was produced. Except having used this solution, it is the completely same method as Example 1, and the gauze which coated the antimicrobial agent content PNIPAAm was produced. The content of the antimicrobial agent was about 4% to coated PNIPAAm. That is, it was 0.08 mg per this 1 cm of covering material ^{2}. When the wound covering material obtained by the above-mentioned method was observed with the scanning transmission electron microscope like Example 1, the structure was completely the same as that of what was obtained in Example 1. The examination of the antibacterial properties of the above-mentioned

antimicrobial agent content covering material was done by the method shown below. On the agar medium which poured 20 ml of NAC agar media (made by EIKEN CHEMICAL CO., LTD.) into a petri dish 90 mm in diameter, and produced them, After carrying out seeding of Pseudomonas aeruginosa (the standard bacillus: GN11189-.aeruginosa) so that it may become the concentration of a $1x10^5$ individual / cm^2, the antimicrobial agent content covering material (3 cm x 3 cm) obtained by the above was put on this agar medium, and it cultivated for two days in a 37 ** incubator. The agar under this covering material was cut off in the 1cmx1cmx0.3cm size after culture, and this was made into the test liquid A, after putting in a 10-ml sterilization isotonic sodium chloride solution (physiological sodium chloride solution) and homogenizing. On the other hand, the agar of the portion in which the above-mentioned covering material has not ridden was cut off in the 1cmx1cmx0.3cm size as a control experiment, and the test liquid B was produced by the same method as the above. Seeding of 0.1 ml of test liquid A and 0.1 ml of the test liquid B diluted 100,000 times was carried out on the same agar medium as the above produced newly, respectively, it cultivated between days at 37 **, and number of microorganism was guessed from the formed colony count. As a result, in the test liquid A, Pseudomonas aeruginosa were not detected to the concentration of Pseudomonas aeruginosa in the test liquid B having been abbreviation $5x10^7$/ml. From this experiment, it became clear that the antibacterial effect of the antimicrobial agent content covering material of this invention was very good.

PNIPAAm used in example 4 Example 1 was dissolved in 10 ** distilled water, and 1 w/w% of solution was produced. Subsequently, after adjusting PH of 20 ml of this PNIPAAm solution to three, 4 ml of 0.5 w/v% cow dermis pepsin solubilization type I collagen solutions (KOKEN CELLGEN I-PC, Koken CO., LTD. make) were added, it mixed well at 10 **, and the solution which contains one copy of collagen to ten copies of PNIPAAm(s) was produced. Subsequently, after covering with the Pharmacopoeia of Japan gauze (Type I) at the bottom into the petri dish whose path is 9.5 cm, 15 ml of the above-mentioned solution was poured in into the petri dish, and gauze was dipped thoroughly. Subsequently, after neglecting this petri dish to the -80 ** freezer for 2 hours and freezing this solution thoroughly, it freeze-dried one whole day and night using the vacuum dryer, and the wound covering material of this invention was produced. When the surface of this covering material was observed with the scanning transmission electron microscope, the same sponge structure as what was obtained in Example 2 was accepted.

Apply back from the regio lateralis of the Wistar rats (male) of 58 weeks old of examples, and a total-layers skin loss wound is abacterially made from an area of 4 cm x 4 cm, After sticking the wound covering material (finishing [ethylene oxide gas sterilization]) of this invention produced in Example 1 to a wound surface, the perimeter was fixed using the ERASUTA band in piles, and eight sterile absorbent gauze was detained for one week. As a control experiment, the total-layers skin loss wound was made by the same method as the above, the sterile absorbent gauze (Type I) of the uncoated Pharmacopoeia of Japan used in Example 1 was stuck to the wound surface, and it detained for one week in the similar way. After one-week detention, after removing the above-mentioned ERASUTA band from the above-mentioned rat under anesthesia and infiltrating enough a 4 ** ice-cooling isotonic sodium chloride solution on the above-mentioned sterile absorbent gauze at fish flour sterile absorbent gauze, one sheet exfoliated this sterile absorbent gauze at a time from the outside. It was difficult to stick the three remaining sheets to a wound surface in a control experiment, when five sheets are stripped from the outside, and to strip easily. When this sterile absorbent gauze was stripped by force, a lot of bleeding was accepted from the wound surface. On the other hand, when the wound covering material of

this invention was used, not only sterile absorbent gauze but wound covering material itself could be easily stripped from the wound surface, and most bleeding from a wound surface was not accepted. After stripping the above-mentioned gauze and the above-mentioned wound covering material from a wound surface, the result observed with the scanning transmission electron microscope is shown in drawing 4 and drawing 5 (the magnification of all is 84 times), respectively. In this drawing 4 and drawing 5, an arrow shows an adhesion organization. As shown in drawing 4 and 5, the organization of the wound covering material of this invention was hardly permitted adhesion of granulation to the organization of the above-mentioned gauze (control experiment) having been permitted adherence of a lot of granulation tissue. The organization of the wound surface of this gauze after stripping the above-mentioned gauze and the above-mentioned wound covering material from a wound surface, this covering material, and both was started, and it fixed with the formalin isotonic sodium chloride solution 10%, and HE (hematoxylin and eosin) dyeing was carried out, and a sample specimen and the preparation were produced. The microphotograph of the sample specimen of this gauze and this covering material is shown in drawing 6 and 7 (the magnification of all is 2100 times). In this drawing 6 and 7, an arrow shows the reproduction skin structure adhering to gauze thru/or wound covering material. The microphotograph of the wound surface after stripping a wound surface and this covering material after stripping this gauze to drawing 8 and 9 (the magnification of all is 2100 times) is shown, respectively. In this drawing 8 and 9, an arrow shows the gauze textiles which remain in a wound surface. Adhesion of granulation was hardly observed in the wound covering material of above-mentioned this invention to a lot of granulation tissue having adhered to the above-mentioned gauze (control experiment) so that these photographs might show. During the organization of the wound surface after stripping gauze, the fragment of covering material was not accepted at all in the wound surface (drawing 9) after stripping the covering material of this invention to the fragment of thread of gauze having been accepted as an arrow showed so that drawing 8 might show. The fragment of thread of the gauze shown in drawing 8 by the arrow may cause foreign body reaction, and may delay wound healing notably.

The covering material of this invention of the shape of sponge produced in example 6 Example 2 was stuck to the total-layers skin loss wound side of the rat by the completely same method as Example 5, and was made to exfoliate from a wound surface by the completely same method as Example 5 after one-week detention. When the covering material of this example was used, it became clear that the detachability from a wound surface was improved compared with the covering material used in Example 5. The audit observation of the microphotograph of this exfoliative covering material, a fixed sample specimen, and the preparation of a wound surface was the same as the case of Example 5 almost. That is, adhesion of the granulation tissue was hardly observed in the above-mentioned covering material. Remains of the covering material of this invention were not observed in a wound surface in-house at all.

The animal experiment was conducted by the completely same method as Example 5 using the covering material of this invention by the antimicrobial agent and silver sulfadiazine (silver sulfadiazine) content which were produced in example 7 Example 3. The detachability from the wound surface of this covering material, the adhesion grade of the granulation tissue to exfoliative covering material, and the remains grade of the covering material to a wound surface organization were completely the same as that of the case of the covering material of this invention used in Example 5, and degradation of the performance of this covering material by containing an antimicrobial agent was not accepted at all.

The animal experiment was conducted by the completely same method as Example 5 using the covering material of this invention of the collagen content produced in example 8 Example 4. The detachability from the wound surface of this covering material, the adhesion grade of the granulation tissue to exfoliative covering material, and the remains grade of the covering material to a wound surface organization were completely the same as that of the case of the covering material of this invention used in Example 6, and degradation of the performance of this covering material by containing collagen was not accepted at all. When the recovery state of the wound surface after this covering material exfoliation was observed histologically, the better thing became clear as compared with the covering material of this invention which does not contain collagen.

[Effect of the Invention]As mentioned above, according to this invention, the wound covering material which consists of a temperature sensitive high molecular compound which has minimum critical solution temperature (LCST) is provided. Based on the heat reversible solubilization characteristic of a temperature sensitive high molecular compound of having the above-mentioned LCST, the wound covering material of this invention is excellent in the absorptivity of the exudate from a wound side, and, moreover, excellent also in the secession nature from a wound side. In the mode in which the wound covering material of this invention contains especially the temperature sensitivity polymers which have LCST lower than a living body's body temperature, In the state where it was stretched in the wound surface, this covering material maintains the function as wound covering material, without dissolving in the solution of the various drugs applied from the outside of the body fluid which exudes from a wound surface, or this covering material. On the other hand, when the time of exchange of this covering material or a wound surface recovers and this covering material is removed from a wound surface, This covering material can be easily exfoliated from a wound surface by sprinkling the water and the physiological saline (the temperature of nearly 4 ** is actually preferred) of a temperature lower than LCST from the outside of this covering material, lowering the temperature of this covering material lower than LCST, making it a damp or wet condition, and making these temperature sensitivity polymers make it aqueous. Therefore, when the wound covering material of this invention is used, it not only does not do damage to a wound surface substantially at the time of this covering material secession, but unlike the case where conventional wound covering material is used, the time and effort at the time of a dressing change (covering material exchange) and a patient's pain are reduced remarkably.

[Translation done.]